

UTAH PUBLIC FIRE EDUCATOR

UTAH STATE FIRE MARSHAL

FIRE CHIEFS PASS EDUCATOR SECTION

"Utah Fire and Life Safety Education Association June 11 the Utah State Fire Chiefs Association created a professional organization for fire and life safety educators in Utah. The creation of the Utah Fire and Life Safety Education Association: A Section of the Utah State Fire Chiefs Association was passed unanimously. Don't worry, we will choose a short nickname such as the Ed Section or the Educator Association. Fire Marshal Dean Hunt was named as the State Chiefs liaison to the section. I, Monica Colby, Public Education Specialist with the Office of the State Fire Marshal, will be the executive secretary, assisting as paid staff to the Association. The first meeting of the Association will soon be announced. We will need officers too (Chair, two Vice Chairs and a Secretary). The purpose of the organization is to provide a greater means of communication, resource sharing and training for those involved in fire and life safety education. There will be a networking lunch at Summer Fire School, Friday, August 15, 2008. Details to be determined, but it looks like we will be meeting in the Utah Valley University cafeteria. Hope to see you there" -Monica



USE YOUR PARENT VOICE

An article in the Journal of the American Academy of Pediatrics studies the comparison of a personalized parent voice smoke alarm with a conventional residential tone fire alarm for awakening children.

The study included a volunteer sample of healthy children 6- to 12-years-old and involved sounding a traditional alarm and an alarm that a parent can record

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SUMMER FIRE SCHOOL

[Summer Fire School](#) on Friday, August 15, 2008 there will be a free daylong (9-4) Fire and Life Safety Education class. We will be covering a number of studies involving smoke alarms, educational programs, suppliers, looking at fire safety retail products, discussing what is working in Utah, what happening in the rest of the world, and what challenges we are facing.



JULY 2008

Points of interest:

- * Do Kids Wake to Alarms?
- * Smoke Alarm Studies Reviewed
- * Alarm Assistance Programs



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FIREMAN'S FUND HERITAGE PROGRAM

Is your Fire Corps program looking for additional funding? The [Fireman's Fund](#) Heritage program is a national community-based program that provides funds for equipment, fire prevention tools, firefighter training, fire safety education, and community emergency response programs. Fireman's Fund employees and agents award grants and provide volunteer support for local fire departments, national firefighter organizations, and burn prevention/treatment organizations.



There is no application form or deadline. Instead, departments are encouraged to complete a [survey](#) on the Fireman's Fund web site. This information is shared with employees, independent agents, field marketing organizations, and brokers/dealers interested in nominating a fire department for a grant.

Visit the [Fireman's Fund Heritage web site](#), take the [survey](#), or to learn more about the grant program.

(Use Your Parent Voice Continued from page 1)

their own voice instructing the child to wake and get out of the room. The children were also taught a self-escape drill and practiced several times to the sound of each type of alarm prior to the actual experiment. Monitoring the children's sleep stage allowed researchers to sound the alarms at the same stage for each child. The results were as follows, "twenty-three (96%) of the 24 subjects awakened to the parent voice alarm compared with 14 (58%) to the tone alarm. One child did not awaken to either stimulus. Nine children awakened to their parent's voice but not to the tone, whereas none awakened to only the tone and not the voice. Twenty (83%) of the subjects in the parent voice alarm group successfully performed the escape procedure within 5 minutes of alarm onset compared with 9 (38%) in the tone alarm group. The median time to awaken was 20 seconds in the voice alarm group compared with 3 minutes in the tone alarm group. The median time to escape was 38 seconds in the voice alarm group compared with the maximum allowed 5 minutes in the tone alarm group.

The study concludes that "the development of a more effective smoke alarm for use in homes and other locations where children sleep provides an opportunity to reduce fire-related morbidity and mortality among children."

To read the article online go to: <http://www.pediatrics.org/cgi/content/full/118/4/1623>

SMOKE ALARM STUDIES REVIEWED

In the past few years much has been made of residential smoke alarms and much has been discovered about smoke and residential building performance in fires. Some of this new knowledge had created a national conversation suggesting change or a more rapid response to this gained information. With this relatively sudden burst of information released in long and technical reports, it's no wonder many public educators find it difficult to know what information is out there. This article is intended to provide a "brief" overview of some of the latest research findings.



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UTAH STATE FIRE MARSHAL

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CITIZEN ADVOCATES ASSISTING FIRE DEPARTMENTS IN NON-OPERATIONAL ROLES= MAKING A DIFFERENCE THROUGH THE FIRE SERVICE

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Background of Reports

The first and last major study of residential smoke alarms was in 1975, performed by what is now the National Institute of Standards and Technology (NIST), and often called the Indiana Dunes study. Most all residential smoke alarm testing, placement, manufacturing and public education messaging has been based on this study.

With the assumption that things might have changed since 1975, NIST was hired to undertake a similar study and published the first technical note in 2004 titled, "Performance of Home Smoke Alarms: Analysis of the Response of Several Available Technologies in Residential Fire Settings." The last revision was in February 2008. Ionization, photoelectric, dual ionization and photoelectric, aspirated photoelectric and carbon monoxide alarms as well as residential fire sprinklers were all studied to some extent. The alarms were measured based on the amount of escape time they provided.

In 2007, Underwriters Laboratories (UL) and The Fire Protection Research Foundation (FPRF), connected with NFPA, produced their joint technical report, "Smoke Characterization Project," as a follow up to the recommendations of the 2004 NIST study.

In 2007, NFPA initiated a task force to review the NIST study as a response to the impact the study has had on the fire service.

How Common Smoke Alarms Work

Photoelectric smoke alarms, also referred to as light scattering smoke alarms, are designed to detect larger particles in the smoke which are common in smoldering fires. The particles enter the alarm and reflect the light to a sensor which triggers an alarm.

Ionization smoke alarms use a small amount of radioactive material to keep a constant flow of air between two charged plates. When small particles and gases most commonly from flaming combustion enter the chamber the flow is interrupted and the alarm is triggered.

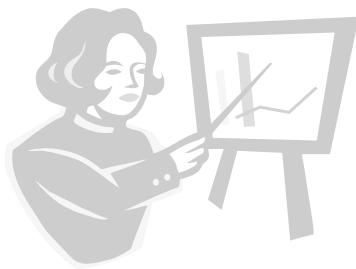
Combination alarms in these studies refer to dual chamber alarms where both photoelectric and ionization detection technologies are used. Aspirated photoelectric alarms periodically test the air. They pull in a sample of air instead of waiting for air to pass through the chamber.

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SUGGESTIONS?

Know of a training or conference? Got ideas to share about curriculum or public fire education? Write: cshort@utah.gov

SMOKE ALARM STUDIES



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Results

When using natural fibers such as wood and cotton batting, fires and smoke alarms responded as expected and as they did in the 1970's. The biggest difference in alarms appears to stem from the different furnishings we now use. Synthetics are widely available and used in most homes. These are generally products derived from crude oil and have difficult to pronounce names that include forms of polymer, urethane, and ethylene.

Natural materials tend to char and may smolder but will not generally have significant impact unless it turns to flames. Crude oil products, however, melt. They smolder for long periods of time, often at greater heat than the natural materials and producing greater amounts of dark smoke with large particulates. Once this hot and smoky fire does transition into flames, it is highly aggressive. *A room can flash over in as little as three minutes with synthetic materials.* The average time is between three and four minutes in a modern, synthetic-filled room.

A smoldering cigarette on a polyurethane couch can leave a room "tenable" for several minutes. Once the smoldering has produced a depression in the foam and airflow is introduced, for example, and it moves to the flaming stage, the smoldering furniture will be engulfed in a matter of tens of seconds. Because the entire room and even the house is full of hot gases, the flames will spread rapidly. Visibility is already lost, carbon monoxide is already at highly dangerous levels and the heat is intense. The flaming fire will be too quick for a traditional flaming fire alarm response because this is not a traditional flaming fire but a new, synthetic fire.

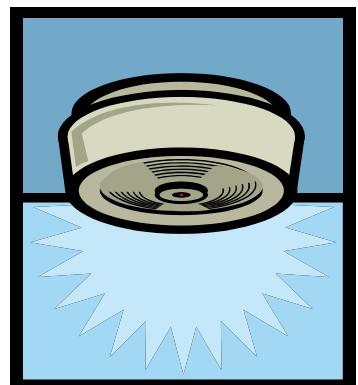
Ionization alarms respond quickly to flaming fires of all types and are relatively responsive to smoldering natural materials. Ionization alarms are very slow to respond, and sometimes did not respond before the end of the test, to smoldering synthetic materials. Photoelectric alarms respond quickly to smoldering fires of all types and relatively responsive to flaming fires of all types.

Flame retardant treatments cause more smoldering and the impact has not been investigated.

The Smoke Characterization Project was intended to track more specific data about smoke to allow us to create better standards, better tests and better alarms. Some interesting things were learned from this study and there is much to still be analyzed and applied. Dominant gases in smoke are water vapor, carbon monoxide and carbon dioxide. They measured the heat of the fires, the gases in the smoke, particulate size of the smoke and so on.

Another interesting fact is that the various conditions of smoke rely heavily on the type of product combusting and the heating mechanism. The common ponderosa pine smoldering fire used by UL217 produces different size of particulates if it is heating on a hot plate as compared to using radiant heat. It is also very different when compared to synthetic smoldering materials.

One very interesting find was that smoke particles, especially large ones from smoldering fires, join together over time and away from the source of ignition. This makes



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them heavier. This happens faster when the ceiling is cool, such as a vaulted ceiling or during the winter. When the smoke particles collect they become heavier and “bank” from the ceiling. This leaves clean air one to two feet from the ceiling. This may explain why an ionization alarm may sound a few times and then clear the alarm on its own.

Tenability and Escape

Performance Based Testing was the purpose of the 2004 National Institute of Standards and Technology (NIST) study. Performance is based on the idea that an alarm is effective if it gives most people enough warning to escape safely from the fire.



What the Results Measure

First, you must know when the alarm goes off and then you must know how long it will take for someone to escape the home once the alarm has sounded. You must know when it is too dangerous to escape, or conditions are no longer tenable.

As soon as there was too much smoke, carbon monoxide or heat, five feet from the ground anywhere along the main escape path, the conditions exceeded the tenability criteria, or the way was considered blocked. If people get low or use an alternate escape route, it will take longer but there is a potential of escape. This situation is not calculated in the study results.

NIST used standards for tenability which included 10% smoke obscuration and 400 ppm carbon monoxide. Smoke obscuration was always reached before the carbon monoxide threshold was reached, just barely. Other world-wide standards indicate that tenability should be set below 175 ppm carbon monoxide. NIST is reviewing their data to see when the available standard egress time would be with this 175 standard. Another note to keep in mind, the tenability for obscuration and heat is considered high, or not strict enough, compared to some international and past NIST studies.

Testing Situations

For this article, results for ionization and photoelectric alarms will be compared. Data for dual sensor alarms is under revision and aspirated photoelectric alarm times were poor.

Alarms were placed in three scenarios: every level – one alarm outside the sleeping areas and on every level; every level and bedrooms – in every sleeping area, outside the sleeping areas and on every level; and every room – an alarm in every room and outside the sleeping areas. These placement scenarios were studied in both manufactured homes and 2-story homes.

In the best case scenario, the family is in the kitchen when there is a cooking fire. They do not take any action other than immediately turning to leave when the alarm sounds.

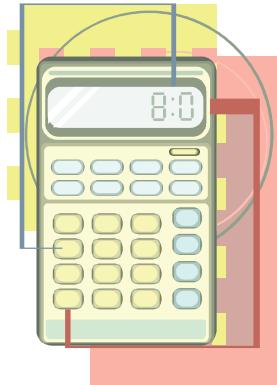
In the worst case scenario everyone is sleeping. The adults immediate wake with the sounding of the alarm, put on a robe, grab the keys and wallet, make a 15 second call to 911, walk into one bedroom and then a second bedroom, taking an average of 7 seconds to wake each child and leave the home. Many things could change this time in reality, but that is the situation for these results.

There are also escape times for two age groups, 30-something adults and 60-something adults.

Escape times needed are shown in figure 1.

Calculations

To determine if an alarm provided adequate escape time in these scenarios given the above conditions, take the time, in seconds from when the alarm activated until tenability was exceeded somewhere along the egress path. Subtract from that the time needed for the occupants to escape and you have your leeway, or how much time is left for something to go wrong.



For example, the time from when the alarm sounded until the tenability of the egress path was exceeded is 120 seconds. A young family in a two-story home during the worst case scenario needs 90 seconds to escape. The alarm gives them adequate time to walk out of their home.

Or in plain English: The family needs 90 seconds to get out and the alarm gave them 120 seconds of warning before their way out was blocked.

When a result is listed as a negative number it means the tenability was exceeded that many seconds before the family could escape in the given scenario. The alarm needed to sound at least that many seconds earlier for the family to safely escape out their main escape route. In many cases it would still be possible to crawl or use a window, if they are willing and prepared to do so.

These results do not include a person who is intimate with the fire. It is assuming that all occupants are in another room at the time of the fire. Smoke alarms are not necessarily effective to alert a person who started the fire and/or is in the room of origin in time to make a safe escape. This is truer for flaming fires than smoldering fires where a person may still escape if alerted to the danger, but it is the basis used in these studies.

Figure 2 shows the results of various tests in a manufactured home with smoke alarms of several types placed in the hallway outside of the sleeping area, or what is categorized as every level. On the left are three flaming fire scenarios, three smoldering fire scenarios and one grease fire in the kitchen. All negative numbers, situations where in the worst case scenario they were unable to fully escape before the path was untenable, are colored. Blue are those within 30 seconds, green are those within 60 seconds and yellow are within 120 seconds.

Let us look at the flaming fire in the living room. The first box, -1, shows that the photoelectric alarm sounded one second too late for the younger family to escape in a worst case scenario and 45 seconds to late for the older family. However, the ionization alarm (better for flaming) gave the younger family an extra 57 seconds to escape and the older family a spare 12 seconds. You will also notice that a smoldering fire in a bedroom when the bedroom door is closed is a very dangerous situation.

Figure 3 shows the same tests and alarms but with them outside of the sleeping area and in every bedroom. Notice that having an alarm in every bedroom makes a significant difference when the door is closed. Now the door is a protectorate rather than a deterrent to notification.

Figure 4 illustrates the same fires and the same alarms but they are in every room. In a manufactured home it is important that there are alarms in every bedroom and in the hallway.

Figure 5 is of the tests for a two-story home, a few different fire scenarios, same alarms and they are outside of the sleeping area and on each additional level. You will see that the photoelectric alarms were slow in the flaming fires for the older family to escape. The red blocks indicate that the way had been blocked for more than 120 seconds. When there was a smoldering fire in the living room and there was forced air flow from an air conditioner, the escape route had be-

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come untenable before the alarm ever sounded. In some tests, the alarm never alerted before tenability criteria were exceeded.

When there is more than one level in the home there is a greater difference in alarms performance. Ionization alarms are not designed to detect smoldering fires. In this situation, the occupant will likely need to use a secondary means of escape when the alarm sounds or they are otherwise alerted.

The times listed in figure 5 are the same for all alarm placement scenarios.

Other Detection and Suppression Systems

The NIST report also tested carbon monoxide alarms, heat alarms, and sprinklers in the rooms of origin. CO was about on par in activating when there was a smoldering fire and when the flaming fire was in the bedroom with the door closed. They lagged behind on all other flaming fires. Heat alarms were consistently slower than the other types of smoke alarms. Sprinklers, which very effective in containing a fire and preventing the spread of smoke, do activate later than the smoke alarms. NIST recommends that smoke alarms still be installed when sprinklers are installed

NFPA Task Force

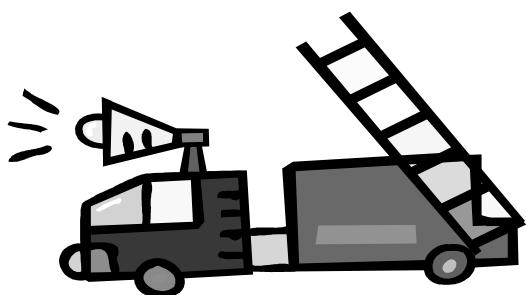
With the controversy over the failure of ionization alarms in these studies and data being collected in various parts of the country, NFPA put together a task force to review the NIST study. They found several errors that have since been corrected. They restated what NIST had said. They also make it clear that they were evaluating the study based on current NFPA 72 standards that require interconnected alarms in ever bedroom, outside of the sleeping areas and on each additional level.

Given these conditions, and if the occupants sleep with bedroom doors closed and are prepared with a secondary exit as NFPA recommends, then most able occupants should be able to survive most fires. This, according to the report, is part of NFPA 72's scope. Interpretation: If you are considering mobile, prepared people living in buildings built to current NFPA 72 standards, any popular smoke alarm will most likely save their lives. If you are considering any other situation, you might want to investigate this alarm thing a little more.

Three task force members submitted minority objection reports due to this filter and some information that was not included in the report and previous updates to NIST reports without explanations.

Nuisance Alarms

Nuisance alarms were also studied, but that is an entire other article. Basically, look to having air movement from a fan while cooking and keep alarms, especially ionization alarms, at least 25 feet from any cooking appliance.



Tables on next page ...

Figure 1:

Escape Time Needed

Scenario		Premovement Time(s)		Movement Time (s)		Total Escape Time (s)	
		M. Home	Two-Story	M. Home	Two-Story	M. Home	Two-Story
Worst Case	Young family at night	55	55	35	35	90	90
	Elderly family at night	80	80	55	60	135	140
Best Case	Young couple in kitchen	--	--	5	10	5	10
	Elderly couple in kitchen	--	--	10	15	10	15

Figure 2:

Manufactured Homes – every level

Alarm placement: every level		photo		ion		Dual ion/photo	
		younger	older	younger	older	younger	older
Flaming							
Living room		-1	-46	57	12	52	7
Bedroom		-32	-77	3	-42	-51	-96
Bedroom (door closed)		786	741	1233	1188	1718	1673
smoldering							
Living room		261	216	47	2	271	226
Bedroom		1292	1247	30	-15	272	227
Bedroom (door closed)		-50	-95	-36	-81	-42	-87
Cooking (Grease)							
Kitchen		502	457	748	703	809	764

Figure 3:

Manufactured Homes — every level and bedrooms

	photo		ion	
	younger	older	younger	older
Alarms: every level + bedrooms				
Flaming				
Living room	-1	-46	57	12
Bedroom	-14	-59	28	-17
Bedroom (door closed)	1321	1276	1371	1326
smoldering				
Living room	261	216	47	2
Bedroom	1458	1413	47	2
Bedroom (door closed)	744	699	-10	-55
Cooking (Grease)				
Kitchen	505	460	748	703

Figure 4:

Manufactured Homes — all rooms

	photo		ion	
	younger	older	younger	older
Alarms: every room				
Flaming				
Living room	38	-7	102	57
Bedroom	-14	-59	28	-17
Bedroom (door closed)	1321	1276	1371	1326
smoldering				
Living room	2323	2278	473	428
Bedroom	1458	1413	19	-26
Bedroom (door closed)	744	699	-10	-55
Cooking (Grease)				
Kitchen	577	532	781	736

Figure 5:

Two-Story Homes – all

Alarms: every level	photo		ion		Dual ion/photo	
	younger	older	younger	older	younger	older
Flaming						
Living Room	18	-32	62	12		
Living Room (Replicate)	44	-6	82	32		
Living Room (Fully-Furnished)	54	4	82	32		
Bedroom	260	210	284	234		
Bedroom (Door Closed)	3326	3276	3348	3298		
Smoldering						
Living Room	3208	3158	-74	-124	3242	3192
Living Room (Air Conditioning)	2683	2633	-144	-194	3242	1968
Cooking (Grease)						
Kitchen	862	812	188	138	844	794

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